Quiz 19 **Name:** Nick Tesla **Score:** 20/ 20

Physics 2020, Adam Johnston

As always, *show all your work* and *circle your final answer*. All numeric values are good to 3 significant figures.

$$F_{net} = ma, \quad w = mg, \quad a_c = \frac{v^2}{r}, \quad K = \tfrac{1}{2}mv^2, \quad \vec{F} = q\vec{E}$$

$$F = qvB\sin\theta, \quad F = I\ell B\sin\theta, \quad \tau = NIAB\sin\theta, \quad B = \frac{\mu_0 I}{2\pi r}, \quad B = \frac{N\mu_0 I}{2R},$$

$$|e| = 1.60 \times 10^{-19}\ \text{C}, \quad \mu_0 = 4\pi \times 10^{-7} T \cdot m/A$$

1. [3 pts.] An positron (positively charged) is heading downward towards the equator of the Earth, where the Earth's magnetic field points to the north. This positron would feel a force to the

A. North	**B.** South	**C.** West	**D.** East	**E.** None of these.

2. [3 pts.] A single strand of wire is carrying a constant current. It produces a magnetic field that

A. is in the same direction as the current.	**B.** is in the opposite direction as the current.	**C.** is in a constant direction, perpendicular to the current.	**D.** makes circles around the wire.	**E.** makes circles that intersect with the wire.

3. [3 pts.] A charge is moving through only a magnetic field. The kinetic energy of the charge will

A. increase.	**B.** decrease.	**C.** remain constant.	**D.** More information is needed to complete this sentence.

4. [8 pts.] A particle with mass 1.67×10^{-27} kg has a kinetic energy of 4.90×10^{-19} J. It moves perpendicular to a magnetic field of 0.260 T (out of the page) while going around in a circle (counterclockwise) of radius 3.08 cm. What is the charge of this particle? (Be sure to include the sign.) Hint: The kinetic energy tells you something about the motion of the charge, which should tell you something about how it reacts in a magnetic field.

$K = \frac{1}{2}mv^2 \rightarrow v^2 = \frac{2K}{m} \rightarrow v = \sqrt{\frac{2K}{m}}$

$F = ma$ ← centripetal

$qvB = m\frac{v^2}{r}$

$q = \frac{mv}{Br} = \frac{m}{Br}\sqrt{\frac{2K}{m}} = \frac{\sqrt{2Km}}{Br}$

4.9×10^{-19} J, 1.67×10^{-27} kg, 3.08×10^{-2} m, .26 T

$= -5.05\times10^{-21}$ C

5. [3 pts.] If the particle in the above problem had the same mass and velocity but more charge, the radius of the circle it traced would have been

A. the same.	**B.** smaller.	**C.** larger.

Note: Not really possible since this is less than e.)